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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/068,928	02/07/2002	Yee-Chia Yeo	2001-1379/24061.421	9422

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EXAMINER
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DOAN, THERESA T

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 01/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/068,928

Applicant(s)

YEO ET AL.

Examiner

Theresa T. Doan

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*(Signature)*

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 16 December 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 and 23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Request for Continued Examination***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/16/05 has been entered. An action on the RCE follows.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1 and 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. (6,221,738) in view of Henley et al. (6,013,563) as previously cited.

Sakaguchi (Figs. 4A-4D) discloses a method of forming a strained semiconductor layer, comprising the steps of: providing a first wafer (figure 4A) with a surface comprising of a first semiconductor layer 103 of a first natural lattice constant; forming a second semiconductor layer 102 with a second natural lattice constant on the first

semiconductor layer, the first and second natural lattice constants being different so as a strain gradient would inherently introduce at the interface of the second semiconductor layer and the first semiconductor layer because of the bonding created at the interface (column 14, lines 1-9); providing a silicon second wafer 106 with a surface of an silicon dioxide insulator layer 105; bonding the second semiconductor layer 102' on the surface of the second wafer 106, resulting in a third wafer (figure 4C) comprised of the second wafer 106, the second semiconductor layer 102', and the first wafer 101 (see figure 4C); and performing an external force (column 14, lines 1-3) cleaving procedure at the strain gradient so that the second semiconductor layer 102' is separated from the first semiconductor layer 103 and the first wafer 101 (see figure 4D). It is noted that the cleaving is facilitated by the strain gradient because the porous layer 103 is separated from the non-porous layer 102 by cleaving performing at the strain gradient introduced at the interface between the porous layer 103 and the non-porous layer 102.

Sakaguchi does not disclose specific of performing an external force that can be used such as water jet.

However, Henley discloses a specific of performing an external force that can be used such as fluid jet (e.g, liquid jet or gas jet) or the compressed fluid source (e.g, pressurized liquid, pressurized gas) for separation layers (column 9, lines 29-52). Accordingly, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to use fluid jet (e.g, liquid jet or gas jet) or the compressed fluid source (e.g, pressurized liquid, pressurized gas) as the external force

for separating the layers in Sakaguchi's cleaving process because the fluid jet can be adjusted in direction, location, and magnitude to achieve the desired controlled cleaving process, as taught by Henley (column 9, lines 45-52).

4. Claims 1-4 and 6-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Godbey et al. (5,013,681) in view of Henley et al. (6,013,563) as previously cited.

Regarding claims 1-4 and 6-7, Godbey (Figs. 9-12) discloses a method of forming a strained semiconductor layer, comprising the steps of: providing a first wafer (figure 9) with a surface comprising of a first SiGe semiconductor layer 72 of a first natural lattice constant (column 5, lines 39-50); forming a second semiconductor layer 74 with a second natural lattice constant on the first semiconductor layer 72, the first and second natural lattice constants being different so as a strain gradient would inherently introduce at the interface of the second semiconductor layer and the first semiconductor layer because of the bonding created at the interface; providing a silicon second wafer (figure 10) with a surface of an SiO<sub>2</sub> insulator layer 82; bonding the second semiconductor layer 74 on the surface of the second wafer, resulting in a third wafer (figure 11) comprised of the second wafer (handle wafer), the second semiconductor layer 74, and the first wafer (seed wafer) (see figure 11); and performing a cleaving procedure so that the second semiconductor 74 is separated from the first semiconductor layer 72 and the first wafer. It is noted that the cleaving is facilitated by the strain gradient because the second layer 74 is separated from the first layer 72 by cleaving performing at the strain gradient introduced at the interface between the second layer 74 and the first layer 72.

Godbey et al. do not show performing a water jet cleaving procedure at the strain gradient to separate the second semiconductor layer from the first semiconductor layer and the first wafer.

However, Henley discloses performing fluid jet (e.g, liquid jet or gas jet) or the compressed fluid source (e.g, pressurized liquid, pressurized gas) for separation layers (column 9, lines 29-52). Accordingly, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to use fluid jet (e.g, liquid jet or gas jet) or the compressed fluid source (e.g, pressurized liquid, pressurized gas) for separating the layers in Godbey's cleaving process because the fluid jet can be adjusted in direction, location, and magnitude to achieve the desired controlled cleaving process, as taught by Henley (column 9, lines 45-52).

Regarding claim 8, Godbey et al. teach in column 5, lines 39-50 and column 3, lines 45-56, the first semiconductor layer is an alloy semiconductor layer comprising of silicon and germanium, epitaxially grown to a thickness between about 0.1 to 10 microns, with a Ge mole fraction between about 5 to 80%.

Regarding claim 9, Godbey et al. teach the second semiconductor alloy layer is a silicon layer under tensile strain (column 4, lines 45-54).

Regarding claim 10, Godbey et al. teach the second semiconductor layer is a silicon layer, epitaxially grown to a thickness between about 20 to 1000 Angstroms (column 3, lines 60-62).

5. Claims 11-13, 15-21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharma et al. (5,344,524) in view of Henley et al. (6,013,563) as previously cited.

Regarding claims 11-13 and 20-21, Sharma (Fig. 5) discloses a method of fabricating a metal oxide semiconductor field effect transistor (MOSFET) device on an insulator layer 22, featuring a silicon channel region 21, comprising the steps of: providing a first wafer 20 with a surface comprising of a first semiconductor material 23 of a first natural lattice constant; forming a second semiconductor layer 21 with a second natural lattice constant on the first semiconductor material so that the second semiconductor layer is strained, the first and second natural lattice constants being different so that a large strain gradient would inherently form at the interface of the second semiconductor layer and the first semiconductor layer because of the bonding reacted at the interface; providing a second silicon wafer 18 comprising of a substrate with an overlying SiO<sub>2</sub> insulator layer 22 (column 3, lines 67-68 and column 4, line 5); bonding the second semiconductor layer 21 on the second wafer 18, with the insulator 22 in between, resulting in a third wafer comprised of the second wafer 18, the second semiconductor layer 21, and the first wafer 20; performing a cleaving procedure so that the second semiconductor layer 21 is separated from the first semiconductor

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material 23, resulting in a fourth wafer comprised of the second semiconductor layer 21 and the second wafer 18. It is noted that the cleaving is facilitated by the strain gradient because the second layer 21 is separated from the first layer 23 by cleaving performed at the strain gradient introduced at the interface between the second layer 21 and the first layer 23; and forming a MOSFET device on the fourth wafer, comprising of a gate structure and of source and drain regions located adjacent to the gate structure.

Sharma et al. do not show performing a compressed air or pressurized fluid cleaving procedure at the strain gradient to separate the desired layers.

However, Henley discloses performing the fluid jet (e.g., liquid jet or gas jet) or the compressed fluid source (e.g., pressurized liquid, pressurized gas) for separation process layers (column 9, lines 29-52). Accordingly, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to use the compressed fluid source (e.g., pressurized liquid, pressurized gas) for separating the layers in Sharma's cleaving process because the fluid jet can be adjusted in direction, location, and magnitude to achieve the desired controlled cleaving process, as taught by Henley (column 9, lines 45-52).

Regarding claims 15-17, Sharma et al. teach the first semiconductor material 23 is an alloy semiconductor layer comprising of silicon and germanium in a relaxed state wherein the alloy semiconductor layer 23 is epitaxially grown to a thickness between about 2 microns, with a Ge mole fraction between about 10% (column 3, lines 49-66 and column 4, lines 44-62).



Regarding claims 18-19, Sharma et al. teach the second semiconductor layer 21 is a silicon layer wherein the silicon layer is epitaxially grown to a thickness between about 0.01-2 microns (column 4, lines 22-30).

Regarding claims 22-23, Sharma et al. disclose a first wafer comprises a silicon substrate 20, a relaxed SiGe layer 23 formed thereon, and a strained silicon layer 21 formed on the SiGe layer (column 4, lines 40-52).

6. Claims 5 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi and Henley OR Godbey and Henley OR Sharma and Henley as applied to claims 3, 12 and further in view of King et al. (4,142,925) as previously cited.

Sakaguchi, Godbey and Sharma teach the insulator layer is a silicon dioxide layer but does not teach an insulator layer is a silicon nitride layer.

However, King et al. in column 2, lines 45-49, teach an insulator layer can be made of others suitable layer such as a silicon nitride layer for the well known purpose of protecting the silicon layer from the contaminants. It would have been obvious to one having ordinary skill in the art at the time of the invention was made to form an insulator layer is a silicon nitride layer in Sakaguchi, Godbey and Sharma's devices as set forth above because as taught by King, such a silicon nitride layer would protect the silicon layer from the contaminants.

### ***Response to Arguments***

7. Applicant states that the applied references do not suggest "said second semiconductor layer is separated from said first semiconductor material due to cleaving facilitated by said strain gradient" as amended. However, the Sakaguchi reference discloses that the second semiconductor layer 102' is separated from the first semiconductor layer 103 and the first wafer 101 due to cleaving facilitated by the strain gradient because Sakaguchi clearly suggest that the second porous layer 103 is separated from the non-porous layer 102 by cleaving performing at the strain gradient introduced at the interface between the second porous layer 103 and the non-porous layer 102 (see figure 4D).

The rest of applicant's arguments, addressed to the amended claims are considered in the rejections shown above.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Theresa T. Doan whose telephone number is (571) 272-1704. The examiner can normally be reached on Monday to Friday from 7:00AM - 4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, WAEL FAHMY can be reached on (571) 272-1705. The fax phone numbers

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for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and (571) 273-8300 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-1562.

A handwritten signature in black ink, appearing to read "TD", is written above the typed name "TD".

TD

January 19, 2006.